Q. **GRANITE CREEK**

(tributary to southeast Pend Oreille Lake)

Summary:
Granite Creek was found to fully support all of its beneficial uses. Beneficial Use Reconnaissance data from 1994, 1995 and 1997 all conclude that the stream is not impaired.

1. Physical and Biological Characteristics

Granite Creek is a 16,712 acre (68 km^2) sub-watershed located on the southeast side of Pend Oreille Lake. Granite Creek originates in the Coeur d'Alene Mountains on the eastern slope of Packsaddle Mountain (elevation 6,400 feet (1951 m)), and flows north and then east to the southern portion of the lake. Several smaller tributaries enter Granite Creek along the way. The Granite Creek sub-watershed also drains the south side of the Green Monarch Ridge (approximately 5,000 feet (1500 m) elevation). Portions of Granite Creek are not considered to be in dynamic equilibrium. Road building and timber harvesting are the causes of channel instability in the upper reaches of the creek, while floodplain development in the lower reaches of Granite Creek limits the ability of the stream to form new channels (PDO Bull Trout PA, 1998).

Rain on snow events occur in this area, but not as great as the north end of Lake Pend Oreille. However, rain on snow peak runoff events can be the largest peak flow of the year in this area (Packsaddle SFEIS, 1997).

The major tree cover types are predominantly Douglas-fir and grand fir. White pine blister rust and intense wildfires have shaped today's vegetative patterns. Past wildfires have removed in-channel woody debris and mature riparian trees (Packsaddle SFEIS, 1997).

The Sullivan Springs tributary of lower Granite Creek is an important kokanee and bull trout spawning area. There are areas of Granite Creek which remain in good condition for bull trout survival, while other reaches are not in good condition.

The lower Granite valley has been impacted by a large subdivision close to the lake, a road up the valley bottom, a power line corridor, and some smaller timber harvesting operations.

2. Pollutant Source Inventory

Point Source Discharges
No point source discharges are known to exist in the Granite Creek watershed.

Nonpoint Source Discharges
Excess bedload deposition, coupled with floodplain impacts which limit the ability of the stream to establish new channels in the reach between Kilroy Bay Road and Sullivan Springs. The primary sources of sediment in this watershed are:

Urbanization - Development in the floodplain has resulted in partial loss of floodplain function.

Because most of the development is within a depositional area, efforts to protect private property have reduced the ability of the stream to use its floodplain and create new channels. Removal of timber and road construction for access to lots has also impaired floodplain function. Granite Creek was reportedly dredged in the reach below the Kilroy Bay Road after a large flood in the early 1970's. A significant portion of the floodplain downstream from the Kilroy Bay Road has been subdivided and developed.

Roads - Road failures have occurred in upper reaches of the watershed. Road density is about 2 miles per square mile of watershed. A portion of the kilroy Bay Road failed during flooding in the winter of 1995-1996, and the road has been relocated. More information is being gathered for roads in this drainage.

Timber Harvest - Approximately 16% of the Granite Creek Watershed has been harvested. Modeling of flow responses to timber harvest suggests the Granite Creek drainage is at moderate risk for increased peak flows (Packsaddle Draft Environmental Impact Statement 1994). Past heavy timber harvesting in riparian areas and in some headwater areas has resulted in downcutting in several headwater reaches and accumulation of excess bedload material in downstream reaches.

2.a. Summary of Past and Present Pollution Control Efforts

A Record of Decision published by the Sandpoint Ranger District of the Idaho Panhandle National Forests in 1997 presented a Selected Alternative for forest management in which there are no proposed timber harvest units and associated road construction in Granite Creek (USDA 1997). This was established so that there would be no sediment yield increases in that watershed (USDA 1997). The selected alternative (Alternative 8) was chosen in part to protect the established beneficial uses in the Granite Creek Watershed.

3. Water Quality Concerns and Status

Granite Creek was listed in 1996 as water quality impaired due to sediment. The results of our Beneficial Use Assessment process for the years 1994, 1995 and 1997 are fully supporting all beneficial uses. Additional monitoring data also concluded that Granite Creek is impaired due to (high) temperature.

3.a. Applicable Water Quality Standards

N/A

3.b. Summary and Analysis of Existing Water Quality Data

Data collected from Granite Creek in 1994 showed full support of all established beneficial uses. Salmonid spawning was not assessed. With a macrobiotic index of 4.55, a habitat index of 107, and 17.4% fine materials in the substrate, Granite Creek was found to be not impaired.

Data collected in 1995 showed similar results. Macrobiotic Indices showed full support of cold water macroinvertebrate communities, and habitat scores were also fairly high. The percentage of fines in these surveys was significantly higher, with the upper site producing 30% fines (particles <6mm in diameter) and the lower site producing a score of 54.20% fines. A fish survey at the lower site again produced numerous salmonids (westslope cutthroat and brook sp.). Beneficial use data collected in 1997 had similar conclusions.

Continuous temperature data collected on Granite Creek from 6/21 through 9/27 produced a mean of approximately 10°C.

3.c. Data Gaps For Determination of Support Status

None

4. Problem Assessment Conclusions

The 1996 Waterbody Assessment Guidance analysis (per IDAPA 16.01.02.053.) indicates that Granite Creek is fully supporting all beneficial uses. Recommendation is to remove it from the 303(d) list of water quality impaired streams.

References

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Dechert, T., Raiha, D. And Saunders, V. 1999. Granite Creek Cumulative Watershed Effects Assessment. September. Idaho Department of Lands. Coeur d'Alene, Idaho.

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R. **GOLD CREEK**

(tributary to southeast Pend Oreille Lake)

Summary:
Gold Creek was placed on the 1996 303(d) list of water quality impaired streams for sediment and habitat alteration. The 1996 Waterbody Assessment Guidance methodology using the 1994 and 1998 Beneficial Use Reconnaissance data concluded that Gold Creek was fully supportive of all beneficial uses. Gold Creek was delisted based upon this finding in the 1998 303(d) list. The 1996 methodology was later discounted, and in April 2000, reference to it was removed from the water quality standards. Currently, we do not have an approved method of determining support status. Recently, new information became available concerning Gold Creek from the Idaho Geological Survey and Idaho Department of Land's Cumulative Watershed Effects analysis. Based upon this information it was determined that Gold Creek was impaired due to sediment and metals pollution. Yearly sediment transport to the stream exceeds natural background by 2,255.3 tons/yr. Metals pollution will not be dealt with until the next 303(d) listing cycle.

1. Physical and Biological Characteristics

The Gold and North Gold Creeks sub-watershed is located on the southeast side of Pend Oreille Lake. Elevation ranges from 6,000 feet (1859 m) near Packsaddle Mountain to 2300 feet (691 m) at Lakeview where the drainages enter the lake. The sub-watershed has both residual and continentally glaciated landscapes. The residual landscape is characterized by moderate to steep slopes with moderate to densely spaced draws. The drainage pattern is dominated by low to mid-order drainages. Slopes are concave to straight at lower elevations and become convex with increasing elevation. Continentally glaciated landscapes are characterized by gentle toe slopes and moderately steep side slopes perched just above Pend Oreille Lake.

Most of the residual part of the drainage is underlain by Precambrian Belt rock. There is also a small amount of Cambrian shale and quartzite and some Lakeview limestone. Lower substratum and surface bedrock are weakly weathered. The glaciated portion of the area has glacial till substratum derived mostly from metasedimentary bedrock sources. The major soils have volcanic ash influenced loess surface layers (12 inches (30cm) -24 inches (60 cm) thick). These layers have a silt loam texture, less gravel and cobble than the underlying residual material, and a high water and nutrient holding capacity. The subsoil and substratum are forming in primarily quartzite and siltite which has a sandy loam to loam texture and 35 to 75 percent subsoil rock fragments. The permeability of most soils are good, except in some of the glaciated soils and some residual draw bottoms and toe slopes where restrictive layers can restrict water movement (USDA, 1997).

The North Gold Creek portion of the sub-watershed includes North Gold and Branch North Gold Creeks. Overall the existing condition of surface erosion in the North Gold Creek portion of the sub-watershed is likely not out of the range of natural variability. Presently channels are still recovering from past fires in 1896, 1926, and 1934 that removed in-channel woody debris and mature riparian trees. Most north facing slopes in the Branch North Gold drainage are naturally highly susceptible to mass wasting. However, because there have been no activities in that area, it seems to be recovering from the previous fires. There has been some localized down cutting in the headwaters to the Branch North Gold as a result of harvesting, however, because of low frequency and distribution the effects have not manifested downstream. North Gold appears to be intermittent above Branch North Gold, yet most of the reaches in North Gold appear to be in dynamic equilibrium. Approximately the first mile of North Gold Creek is not in dynamic equilibrium, as evidenced by head cutting, high raw banks, loose of channel armoring, and extended periods of intermittent flow compared to reaches just upstream. The cause appears to be whole riparian clearing and in-channel woody debris removal while the property was in private ownership up until 5-10 years ago (USDA, 1997).

The steeper reaches below the confluence of Gold and North Gold Creeks are in equilibrium, with year-round flows. Riparian vegetative cover is mature, but most of the over-mature timber has been removed for wood products, creating diminished fish habitat complexity in the lower reaches.

The Gold Creek portion of the sub-watershed includes West Gold Creek, Chloride Gulch, Gold Creek, and Kickbush Gulch. Only Gold Creek is listed as water quality-limited. Overall the existing condition of surface erosion in the West Gold Creek and Kickbush Gulch drainages are likely not out of the range of natural variability. Channels in West Gold Creek drainage are also recovering from past fires. West Gold Creek is somewhat different from other drainages in the sub-watershed in that the forested riparian has not been burned or logged. However, cutting units in the headwaters have caused low frequency, localized down cutting but the effects are not realized downstream. Other portions of the drainage including Kickbush Gulch experience the same scenario of very scant in-channel woody debris which appears to have triggered headwater down cutting since the last fires of the mid-1930s. Intermittent channels in Kickbush Gulch are sporadic until the confluence with Cheer Creek, where year-round flow continues (USDA, 1997).

Chloride Gulch and Gold Creek above the confluence with West Gold Creek are not presently in dynamic equilibrium. Both channels go dry for most of the summer season. All intermittent reaches have diverged from normal ranges with regard to width/depth ratios, channel confinement, and/or channel sinuosity. They are also downstream areas from extensive mine waste deposits that are located in stream channels or flood plains. In Gold Creek alone the waste from the Conjecture Mine has already contributed an estimated 50,000 cubic yards (38228 m^3) of sediment into the channel with another 110,000 cubic yards (84101 m^3) available with future runoff. The Weber mine in Gold Creek and the Idaho Lakeview Mine in Chloride Gulch also have introduced and continue to supply these channels with exaggerated sediment supplies.

Approximately three river miles of West Gold Creek above the confluence with Chloride Gulch could serve as a realistic reference condition for similar streams at elevations between 2,600 feet (792 m) and 3,200 feet (975 m). These relatively "undisturbed" headwater streams differ from affected areas in the drainage in that they are less frequently down cut. Down cutting that does exist in the undisturbed areas is generally much older than the logged, unbuffered streams as evidenced by increased wood recruitment.

Below 2,600 feet (792 m) elevation channel hydrology is within ranges expected for the channel types on these landforms. Even the elevated sediment from past practices (homesteading and mining) pass through the reaches without affecting channel shape. However, the rate of alluvial fan development has probably been accelerated.

Both Gold and North Gold Creeks sub-watersheds are relatively undisturbed above 3,200 feet (975 m) and below 2,600 feet (792 m) elevation. In Gold Creek, past and existing mine waste deposits are the principle sources of sediment. The mines are on private land. North Gold Creek is relatively undisturbed compared to Gold Creek. Riparian treatment along the old homestead area is the chief source of sediment in this area. The homestead area is now under USFS management.

The Gold Creek watershed is 19.7 square miles (51 km^2), forested and primarily managed for timber production. There is recreational use of private land near the mouth of Gold Creek. There is 0.8 miles (1.3 km) of road per square mile of watershed (Patten,1998).

The majority of land is owned by the USFS, 43 acres (0.174 km^2) are privately owned old mining sites, and the town of Lakeview located at the mouth of Gold Creek. Lakeview is isolated in the winter with the primary means of access by boat. Outdoor recreation is the main economy of Lakeview.

History and Economics: Outdoor recreation is currently the main economy of Lakeview. The Gold Creek watershed was a boom area for mining beginning in the late 1800s. Silver, gold, lead, zinc, antimony and silica were mined from the upper reaches of the Gold Creek watershed. What remains of this industry are waste rock and tailings piles, old mill buildings and cleared but now vacant home sites.

2. Pollutant Source Inventory

Point Source Discharges

There have been no point source discharge permits issued for Gold Creek, however, numerous point sources from mine adits discharge to Gold Creek and its tributaries. Most discharges are seasonal and/or flow sub-surface.

Nonpoint Source Discharge

Nonpoint sources found to be threatening water quality in the Gold Creek watershed are outlined as follows:

Mining - Past mining operations in the watershed have impacted this stream and continue to affect channel equilibrium. Chloride Gulch and Gold Creek, above the confluence with West Gold Creek, both exhibit channel disequilibrium and intermittency as a result of excess bedload inputs stemming from mining operations. These streams tend to go dry for most of the summer season in areas where width/depth ratios, channel confinement, and channel sinuosity are outside normal ranges. All intermittent reaches in Gold Creek are located downstream of areas where extensive mine waste deposits were placed directly in the steam. Waste from the Conjecture Mine has already contributed an estimated 50,000 cubic yards of sediment into the channel, with another 110,000 cubic yards available with future runoff (USDA 1997). The Weber Mine in Gold Creek and the Idaho Lakeview Mine in Chloride Gulch have introduced and continue to supply the stream channel with large sediment loads (Corsi et al.,1998). Recent data collected by the Idaho Geological Survey indicates that mine adits and mine waste are causing elevated metals concentrations in water and soil. These levels often exceed standards for cold water biota.

Roads - The Kickbush Gulch slide has a history of failures which have contributed fine sediment to Gold Creek. A large road failure occurred in 1996 in the Kickbush area which contributed significant amounts of road and hill slope material to this stream.

Power Line - Separate Bonneville Power Administration and Washington Water Power (Avista) transmission lines span Gold Creek in the lower reach near Lakeview. Timber and vegetation were cleared in a 250 foot corridor for line construction in the early 1950's. The lines cross Gold Creek, then run parallel to West Gold Creek at one location. Loss of woody debris recruitment may affect this portion of the stream, and shade is diminished.

Timber Harvest - Approximately seven percent of the Gold Creek drainage has been logged. Long term recruitment of woody debris has been lost in some headwater tributaries due to past timber harvest. Post-fire salvage in riparian areas in some portions of the watershed has reduced large woody debris recruitment to streams. There is also the possibility of increased sediment bed loads occurring as direct and indirect results of timber harvest practices.

Wildfire - The Gold Creek stream channel is still recovering from past fires in 1896, 1926, and 1934 that removed live mature riparian trees.

Urbanization - Some residential home sites exist along the lower stream reach. Although not major, riparian impacts and stream bank disturbances have occurred.

Dams and Diversions - Migration by post-spawning bull trout and other salmonids out of Gold Creek may be hindered as an indirect result of lake level fluctuations by Albeni Falls Dam. Peak runoff flows in Pend Oreille tributaries generally occur before the Clark Fork River peaks and fills the lake to its summer elevation (2062 ft. mean sea level). Consequently, coarse bedload material carried downstream by Gold Creek during high flow is deposited in an alluvial fan which has formed near the winter lake level elevation.

2.a. Summary of Past and Present Pollution Control Efforts:

The Lakeview Local Working Committee identified sediment and bedload as the primary pollutants impairing fish habitat in Gold Creek. Other concerns expressed by the Committee include:

1. Closure of the landfill located near Gold Creek, which was achieved by 1994.
2. Reduce sediment delivery from Kickbush Slide.
3. Gravel bars at mouth of Gold Creek impairing fish passage.
4. The DEQ needs to explore how to rehabilitate old mining sites. DEQ sought to obtain grant money for preliminary site assessment, effort not successful.
5. Close ford that crosses Gold Creek under the BPA powerlines.
6. Prior to further timber harvesting activities, USFS should assess water yield impacts the work may cause. Models used for the analysis should be verified in the field. By 1994 the USFS was using a variety of watershed models and on the ground stream surveys.
7. Better communication between USFS engineers and foresters was recommended and achieved through regularly scheduled meetings.

8. BPA was informed of recommended BMPs for powerline slashing.
9. Better implementation of BMPs especially on inactive forest roads.
10. Mining and septic systems are other sources of pollution which need to be addressed.
11. Education of 250 land owners and operators about how to work near streams.
12. Noxious weed control needs to be addressed.

Some of the recommendations of the Lakeview Local Working Committee were not acted upon by the time the Committee was disbanded in 1994.

3. Water Quality Concerns and Status

In 1996 Gold Creek was added to the 303(d) list as water quality impaired due to excess sediment and habitat alteration. Gold Creek has existing uses of domestic water supply, cold water biota, salmonid spawning and primary and secondary contact recreation. Gold Creek is currently the second most important bull trout spawning stream in the Pend Oreille watershed. Excess bedload is considered to be the single greatest limiting factor for bull trout habitat in the Gold Creek watershed. This stream has been heavily impacted primarily due to mining and its associated activities. Mine waste and adit water are causing metals contamination of soils and water. Recently, the U.S. Forest Service has begun a process of site evaluation and search for responsible parties that may eventually result in a CERCLA ("Superfund") cleanup.

3.a. Applicable Water Quality Standards

Gold Creek was listed in 1996 as water quality impaired from its headwaters to Pend Oreille Lake for sediment and habitat alteration. Standards which address these pollutants are those for turbidity, cold water biota, salmonid spawning and domestic water supply.

3.b. Summary and Analysis of Existing Water Quality Data

a) Data Sources: USFS and DEQ
Twenty four percent of Gold Creek is 2% slope or less, 27% is above 6% gradient. Average flow is 20.4 cfs, high flow is 232 cfs, and low flow is 1.8 cfs. Rosgen stream classification B.

b) Water Column Data:
Kauffman and Rember (1998) sampled adit and stream water in the Lakeview mining district located in the Gold Creek drainage. Results of the analysis indicate numerous exceedences of the Environmental Protection Agency's *Quality Criteria for Water 1986* (Gold Book) limits for metals concentrations. Aquatic life and drinking water were the most frequently exceeded values. Metals that exceeded standards included aluminium, arsenic, cadimium, copper, iron, lead, manganese, mercury, and zinc.

c) Other Water Quality Data:
Fish tissue sampling indicated Pb and Hg levels may limit fish consumption (DEQ-Hoelscher memo). DEQ BURP data: MBI=4.56, HI = 78. Septic systems in the vicinity of the mouth of Gold Creek have been moved further uphill away from the creek. These

systems are now constructed on suitable soils, which has alleviated concerns about failed septic systems in this location (Ed Braun-PHD personal communication). Wildfires occurred in 1896, 1926 and 1934.

d) Beneficial Use Reconnaissance Data: Gold Creek was listed as impaired on the 1996 303(d) list for sediment and habitat alteration. The 1998 Beneficial Use Reconnaissance data recorded a stream temperature of 17.5°C. However, the 1997 Hobo continuous temperature measurements taken from 6/21 to 9/27 recorded an average temperature of approximately 8°C, which is below criteria for cold water biota, salmonid spawning, and bull trout. The Hobo data combined with field observations shows that Gold Creek meets the temperature standard only because the stream has been buried by excess bedload and mining related stream alterations. A macrobiotic index completed for data collected in 1994 produced a score of 4.56, and a Habitat Index score of 78. Other data collected at this time reported a Wolmann pebble count of 13.30% fines (particles <6mm diameter), discharge of 15.10 cfs, 45% canopy closure, and 22 pieces of large woody debris within bank full of a 140 meter reach. In 1998 the upper and lower portions of Gold Creek were again assessed. The upper site had a macrobiotic index score of 3.57 and a habitat index score of 55. The lower site had a macrobiotic index score of 4.8 and a habitat index score of 89.

e) Cumulative Watershed Effects Data:
In 1998, Gold Creek was evaluated as a part of the Cumulative Watershed Effects program developed by the Idaho Department of Lands. This program has been instated as part of the Idaho Forest Practices Act. In contrast to indirect indicator and model-based approaches, this program relies on direct observations made in the stream and on the surrounding landscape. The process consists of an assessment of fine sediment in stream bottoms, channel stability, sediment delivery, water temperature/stream shade, nutrients, and hydrology, as affected by forest practices. This evaluation produced results on forested lands in the Gold Creek watershed as summarized below by Dechert et al. (1999):

Category	**Scores**	**Ratings**
Channel Stability Index	53.5	Moderate
Canopy Removal Index	0.29	N/A
# Segments w/Low Temp	6/9	*
# Segments w/High Temp	3/9	*
Canopy Closure/Temperature Rating	*	High
Roads	22.8	Low
Skid Trail	2	Low
Mass Failure	12.5	Low
Total Sediment Delivery	37.3	Low
Nutrient Current Condition	25	Low
Nutrient Hazard Rating	*	High
Overall Nutrient Rating	*	Moderate
Hydrologic Risk Rating	*	Moderate
CWE Surface Erosion Hazard	*	Low
CWE Mass Failure Hazard Rating	*	High

This data indicated the following results:

a) Adverse conditions are identified for three canopy closure/stream temperature segments. Cumulative watershed effects management practices will be developed to address this situation.

b) Two road segments are identified as significant management problems. These roads require attention of the land managers.

c) The guidelines developed by the Lakeview Local Working Committee for the Stream Segment of Concern program should continue to be implemented.

3.c. Data Gaps For Determination of Support Status

Gold Creek requires additional metals monitoring, total suspended solids and turbidity sampling. In addition, comments received concerning this TMDL expressed concerns that clearcuts in this watershed have caused an accelerated runoff affecting water quantity, temperature, peak flows and bedload movement. Flow and habitat are two parameters that Idaho does not recognize as regulated pollutants under the Clean Water Act, even though these elements could prevent complete restoration of beneficial uses. If Idaho's position changes, these two parameters should be examined with respect to attaining full support.

4. Problem Assessment Conclusions

In the absence of an approved beneficial use assessment process, other available data indicates that Gold Creek is not supporting its beneficial uses. Excess sedimentation, primarily from past mining practices, are causing this impairment. Gold Creek is also impaired due to metals pollution and requires listing for this impairment and additional monitoring for metals. Stream temperature is kept low artificially, due to its sub-surface flow resulting from mining impacts. If surface flows were restored, inadequate canopy cover would cause elevated temperatures. A temperature TMDL should be considered for this situation, particularly because of its importance to bull trout.

5. TMDL

Problem Statement: Excess sediment is impairing the beneficial uses of cold water biota and salmonid spawning in Gold Creek.

5.a. Numeric Targets

See attached spreadsheet.

5.b. Source Analysis

See attached spreadsheet.

5.d. Allocations

See attached spreadsheet.

5.c. and 5.e. Monitoring Plan and Linkage Analysis

Because Idaho's Water Quality Standard for sediment is narrative and not based upon something directly measurable in the water column, a different approach is required to achieve a satisfactory monitoring plan. An analysis of the methods available for monitoring the success of TMDLs indicates that, in this case, more than one method should be used to verify the cause of the impairment, track load reduction, and to show that the stream is moving towards full support. The sediment monitoring plan will include three parts:

1. Determination of support status using Beneficial Use Reconnaissance monitoring. If the conclusion of the survey is no impairment for two surveys taken within a five year time period then the stream can be considered restored to full support status.

2. Load reduction measures shall be tracked and quantified. For example, 1.2 miles of road obliteration near a stream, 0.5 miles of stream bank fenced, 5 acres of reforestation, etc.

3. Amount of sediment reduction achieved by implementation of load reduction measures shall be tracked on a yearly basis. For example, 1.2 miles of road obliteration will result in a 6 tons/yr reduction, 0.5 miles of stream bank fenced will result in a 3 ton/yr reduction, 5 acres of reforestation will result in a 0.7 ton/yr reduction, etc.

The reason for this three part approach is the following:

1. DEQ presently uses the Beneficial Use Reconnaissance data to indicate if the stream is biologically impaired. Often times this impairment is based upon only one Reconnaissance survey. The survey should be repeated to insure that the impairment conclusion is correct and repeated twice after implementation to determine if the (improved) support status conclusion is correct. Survey data may show an impairment in fisheries or macroinvertebrates and the cause of the impairment may point to sediment pollution. However, there is not a direct linkage between the pollutant and the impairment. Sediment could be indicated as the problem when, in fact, temperature might be the problem. The Reconnaissance data is not specific as to the cause, just that there is a problem. So using the Reconnaissance data alone to monitor the TMDL is not adequate.

2. There is great uncertainty about how much sediment actually needs to be reduced before beneficial uses are restored. These TMDLs use a very conservative approach, in that the sediment target is limited to natural background amounts. However, beneficial uses may be fully supported at some point before this target is achieved. Therefore, a measure of sediment reduction cannot be used

exclusively to determine a return to full support.

3. Because TMDLs are based upon target loads measured in a mass per unit time there must be a method included to directly measure load reductions. Coefficients which estimate sedimentation rates over time based upon land use have been used to develop the existing loads. This same method can be used for land where erosion has been reduced. Road erosion rates are based upon the Cumulative Watershed Effects road scores. These scores can be updated as road improvements are made and the corresponding load reduction calculated.

5.f. Margin of Safety

Because the measure of sediment entering a stream throughout the entire watershed is a difficult and inexact science, assigning an arbitrary margin of safety would just add more error to the analysis. Instead, all assumptions made in the model have been the most conservative available. In this way, a margin of error was built into each step of the analysis. For an explanation of how the Cumulative Watershed Effects data was collected and processed, refer to the Idaho Department of Lands manual titled, "Forest Practices Cumulative Watershed Effects Process For Idaho". One important detail to note when looking at how the Cumulative Effects data was used in the TMDL is that, although all forest roads in the watershed were not assessed, the field crews are directed to assess the roads most likely to be contributing sediment to the stream. This weighted the average road scores towards the ones most likely to be in poor condition.

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Gold Creek: Land Use Information

Land Use		*Explanation/Comments*
Sub-watershed	Gold Creek	
Pasture (ac)	**0**	
Forest Land (ac)	**6,592**	
Unstocked Forest (ac)	**6,592**	Includes once burned areas
Highway (ac)	0	State or County Paved Highways
Double Fires (ac)	2197	Areas which have been burned over twice
Road Data		
Sub-Watershed	Gold Creek	
1. Forest roads (total miles)	**49.6**	
CWE road score (av)	22.8	
*Sediment export coefficient (tons/mi/yr)	**5.8**	
#Total Forest Rd Failures (cubic yds delivered)	**40**	*Cumulative Watershed Effects Data*
##2. Unpaved Co.& priv. roads (total miles)	0.6	
Paved Co.&priv. roads (total miles)	0	
Total C&P Rd Failures (cubic yds delivered)	0	*Based on weighted average of forest road failures.*
###Stream bank erosion-both banks (mi)		***erosion coefficients*
poor condition	**15.4**	*95 tons/yr/mi*
good condition	**6.2**	*47.5 tons/yr/mi*

*McGreer et al. 1997
**Stevenson 1999. Good Condition: 5,280' X 2' high bank X 90lbs/ft3 X 0.1 ft/yr X 1ton/2000lbs = 47.5 tons/yr/mi
Poor Condition: 5,280' X 2' high bank X 90lbs/ft3 X 0.2 ft/yr X 1ton/2000lbs = 95 tons/yr/mi
#Total road failures are the amount of sediment observed by the CWE crews that was delivered to the stream. This amount is used to represent the yearly delivery to the stream.
This is an over-estimate of sediment delivered to the stream since failures can continue to deliver sediment to the stream for a number of years after they occur, however, in a much reduced quantity. One must also take into consideration that all failures were not observed, which is an under-estimate of delivered sediment. These two factors combined with on-site verification by a

largest failures which probably occurred during the floods of 1996.
##County and private road erosion derived from using the same method as forest roads. Since the method used for foest roads is not designed for non-forest roads,
the calculations will be revised if a better method can be found using the existing information.
###Source of data from DEQ 2000 bank inventory survey.

Gold Creek: Sediment Yield

Sediment Yield From Land Use		*Explanation/Comments*	
Watershed:	Gold Creek	*Acres by Land Use X Sediment Yield Coefficient = Tons Sediment/yr*	
		Yield Coeff. (tons/ac/yr)	
Pasture (tons/yr)	0.0	*0.14*	
Forest Land (tons/yr)	250.5	*0.038*	
Unstocked Forest (tons/yr)	112.1	*0.017*	*(this acreage is a subset of Forest Land acreage)*
Highway (tons/yr)	0	*0.034*	
Double Fires (tons/yr)	37.3	*0.017*	*(this acreage is a subset of Forest Land acreage)*
Total Yield (tons/yr)	**399.9**	*(Values taken from WATSED and RUSLE models see below explanation [#])*	

*Sediment Yield From Roads			
Watershed:	Gold Creek		
Forest Roads (tons/yr)	**287.7**	*Miles Forest Rd X Sediment Yield Coeff. from McGreer Model*	
Forest Road Failure (tons/yr)	**57.2**	***Assumes soil density of 1.7 g/cc and a conversion factor of 1.431.*	
County and Private Roads (tons/yr)	**3.5**		
Co. and Private Road Failure (tons/yr)	0		

*Percent fines and percent cobble of the Pend Oreille - Treble series B&C soil horizons is 80% fines, 20% cobble (Bonner Co. Soil Survey).
**"Guide for Interpreting Engineering Uses of Soils" USDA, Soil Conservation Service. Nov. 1971.
#Land use sediment yield coefficients sources: Pasture (0.14) obtained from RUSLE with the following inputs: Erosivity based on precipitation; soil erodibility based on soils in the watershed; average slope length and steepness by watershed; plant cover of a 10 yr pasture/hay rotation with intense harvesting and grazing; and no support practices in place to minimize erosion.
Forest Land (0.038) obtained from WATSED with the following inputs: landtype and size of watershed
Unstocked Forest (0.017) obtained from WATSED with the following inputs: Acreage of openings, landtype and years since harvest.
Highways (0.034) obtained from WATSED with the following inputs: Value obtained from the Coeur d'Alene Basin calculations.
Double Fires (0.017) obtained from WATSED with the following inputs: Acreage, years since fire and landtype.

Gold Creek: Sediment Exported To Stream

	Gold Creek
Land use export (tons/yr)	399.9
Road export (tons/yr)	291.2
Road failure (tons/yr)	57.2
Bank export (tons/yr)	
poor condition	1463.0
good condition	294.5
Total export (tons/yr)	**2505.8**
*Natural Background Mass Failure (tons/yr)	0

*Background mass failure is the difference between the total mass failure observed in the watershed, and the mass failure associated with roads.

Gold Creek

	Acres	Yield Coefficient (tons/ac/yr)		Background Load (tons/yr)
Total Watershed	6,592			
Presently Forested	6,592			
Estimated Historically Forested	6,592	0.038		250.5
Estimated Historically Pasture	0	0.14		0
Natural Mass Failure (tons/yr)	0			0
Background Load = Target Load			**Target Load**	**250.5**
			Existing Load	**2505.8**
			Load Reduction	**2255.3**